

Discriminating phytoplankton functional types (PFTs) in the coastal ocean using the inversion algorithm PHYDOTax and airborne imaging spectrometer data

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There is a need in the Biological Oceanography community to discriminate among phytoplankton groups within the bulk chlorophyll pool to understand energy flow through ecosystems, to track the fate of carbon in the ocean, and to detect and monitor-for harmful algal blooms (HABs). The ocean color community has responded to this demand with the development of phytoplankton functional type (PFT) discrimination algorithms. These PFT algorithms fall into one of three categories depending on the science application: size-based, biogeochemical function, and taxonomy. The new PFT algorithm Phytoplankton Detection with Optics (PHYDOTax) is an inversion algorithm that discriminates taxon-specific biomass to differentiate among six taxa found in the California Current System: diatoms, dinoflagellates, haptophytes, chlorophytes, cryptophytes, and cyanophytes. PHYDOTax was developed and validated in Monterey Bay, CA for the high resolution imaging spectrometer, Spectroscopic Aerial Mapping System with On-board Navigation (SAMSON – 3.5 nm resolution). PHYDOTax exploits the high spectral resolution of an imaging spectrometer and the improved spatial resolution that airborne data provides for coastal areas. The objective of this study was to apply PHYDOTax to a relatively lower resolution imaging spectrometer to test the algorithm's sensitivity to atmospheric correction, to evaluate capability with other sensors, and to determine if down-sampling spectral resolution would degrade its ability to discriminate among phytoplankton taxa. This study is a part of the larger Hyperspectral Infrared Imager (HyspIRI) airborne simulation campaign which is collecting Airborne Visible/Infrared Imaging Spectrometer (AVIRIS) imagery aboard NASA's ER-2 aircraft during three seasons in each of two years over terrestrial and marine targets in California. Our aquatic component seeks to develop and test algorithms to retrieve water quality properties (e.g. HABs and river plumes) in both marine and in-land water bodies. Results presented are from the 10 April 2013 overflight of the Monterey Bay region and focus primarily on the first objective – sensitivity to atmospheric correction. On-going and future work will continue to evaluate if PHYDOTax can be applied to historical (SeaWiFS and MERIS), existing (MODIS, VIIRS, and HICO), and future (PACE, GEO-CAPE, and HyspIRI) satellite sensors. Demonstration of cross-platform continuity may aid in calibration and validation efforts of these sensors.